Hybrid Migrating Birds Optimization Strategy for t-way Test Suite Generation

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Abstract. Hybrid meta-heuristics algorithms have gained popularity in recent years to solve t-way test suite generation problems due to better exploration and exploitation capabilities of the hybridization. This paper presents the implementation of meta-heuristic search algorithms that are Migrating Birds Optimization (MBO) algorithm and Genetic Algorithm (GA) hybrid to a t-way test data generation strategy. The proposed strategy is called Elitist Hybrid MBO-GA Strategy (EMBO-GA). Based on the published benchmarking results, the result of these strategies is competitive with most existing strategies in terms of the generated test size in many of the parameter configurations. In the case where this strategy is not the most optimal, the resulting test size is sufficiently competitive.

1. Background

The need for error free software is vital today due to our dependency on software in every day's jobs. Unfortunately, software could never be error free. Therefore, it is important to reduce the errors in software by any means possible without incurring huge cost. A proper planning is needed for the software testing phase because half of the labor expended to develop a working program is typically spent on testing activities [1].

Different configurations factors should be considered during system testing such as parameter settings, environmental settings and user input values [2]. It is impossible to test all possible combinations of parameter values of a large system. Therefore, t-way testing technique is chosen because it is known as an efficient and effective testing technique. The problem of finding the smallest set of test cases for t-way testing is known to be an NP-hard problem; meaning that there are no known series of steps (algorithms) that could solve the problem in a feasible amount of time.

T-way methods at first define the model the system under test with different set of the system's parameters and its values. Then, covering arrays (CA) is computed as a set of possible combinations from the parameters and values is computed, in which each valid combination of option settings for every combination of t options appears at least once by using the defined model [3].

CA are mathematical notations that are applied in testing applications where faults are detected with parameter configurations' interactions [24]. CA has been used for t-way test suite generation for the last 20 years [25]. Uniform strength CA is a CA with the same number of configuration value can be represents as CA ($N;t,v^k$) , where N is the final test suite size, t is the interaction strength, v is the uniform configuration value and k is the number of parameters. Mixed Covering Array (MCA) is a